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WILLIAM FAIRBAIRN.

"Power to let." Such were the words which some quarter of a century since struck our eye as we traversed the streets of Manchester for the first time. "Power to let?" What could the words mean? We had just left college, and were fresh from the discussions of the schools respecting the origin of man's idea of power, and all the metaphysical jargon connected therewith. Power, therefore, to us meant mental and moral power, a quality inherent in the soul. How, then,

Our age is the age of the steam-engine. The steam-engine is the symbol of the age. The fact has been made use of to the disparagement of this generation. But the fact has its bright side. The augmentation of man's material forces is in itself a good. What in the whole history of the world has augmented those forces so much as the steam-engine?

In the sphere of material forces, as in other spheres, like



WILLIAM FAIRBAIRN, OF MANCHESTER.

could power be "to let?" Light soon dawned on our mind, and by "power" we found steam-power was intended. And veritably the steam-engine is a power, a great social power; nay, if viewed in its remoter results, a great moral and spiritual power; for the steam-engine, by facilitating intercourse, economises time, abridges space, wears down prejudices, enlightens minds, and unites while it enlarges hearts.

requires and begets like. Discoveries come in a group; improvements go forward hand in hand. The steam-engine would have been of small service without the railway: the existence of the former called the latter into being. Other applications of steam-power ensued as a natural consequence. Hence the rapid and amazing change which has taken place in our means of locomotion within the last hundred years. This change, so very easy to set down on paper or to express in print

has been effected in the face of innumerable difficulties. The progress and the transition have been well sketched by Mr. Thomas Bazley in his "Lecture on Cotton."

"Up to the seventeenth century, goods passing between Liverpool, the destined port of the cotton-trade, and its manufacturing capital, Manchester, had been carried by pack-horses and in waggons; but in 1720 an act of Parliament was obtained for rendering the idle waters of the rivers Irwell and Mersey useful and navigable, though much opposed by the pack-horse and waggon interests. In 1758, however, the Duke of Bridgewater engaged that most practical and distinguished engineer, Brindley, to construct works in harmony with the other achievements of his time; and he was empowered to disembowel the estate of the duke at Worsley of coal, and to construct a canal to convey that welcome fuel to the profitable market of Manchester. This engineer, with singular boldness, directed his canal at a low level, to penetrate the very mines which were to be excavated, and he proposed to cross the river Irwell, at Barton, with it, by an aqueduct at a considerable height; but before he would proceed with his design, he desired his patron to consult some experienced engineer upon the difficulty to be surmounted; and on the duke applying to such an one, the sarcastic reply was, that 'many a castle in the air had been projected, but the place which one was intended to occupy was only then pointed out;' but with unbounded confidence in Brindley, the duke ordered the work to be executed; and the first canal of our country started into successful existence. Assured of the success of a new and great principle, and seeing, with prophetic penetration, that the growing wants of an infant manufacturing and commercial community would require facilities of transit, in addition to the retiring pack-horse, to the waggon, and river conveyances, and that a canal might be constructed with great advantage, to place Liverpool and Manchester in more direct and immediate communication, in 1762 was begun the celebrated Bridgewater Canal, which became another triumph of that energetic age; but it may be well to remark, that before the legislature sanctioned this last projection, the interests of the old carriers, including the river company, were fiercely directed against this innovation upon vested privileges. Conveyance was of indispensable importance to the industry which had continually enlarged its productions; it was requisite for the transport of fuel, food, raw materials and manufactured goods; as well as for those business visits which merchants and manufacturers had to exchange, and which were then effected by that novel agent a stage-coach. Subsequently the career of progress decreed that the mighty power of steam should be the impelling principle of traffic and locomotion; and here again the energy of Lancashire was displayed, for the first efficient railway in the kingdom was established between Liverpool and Manchester, continuing to their trade and commerce the onward impulse of rapid progress. Was this railway established without difficulty? No. The engineering difficulties were said to be insurmountable; but before these were permitted to be grappled with, the legislature, through the combined and powerful interests of the carriers upon the old roads, the proprietors of coaches, canals, the river navigation, and of extensive landowners, who had not the penetration to discern that a new path of progress was projected which would enhance the value of their own property, and also benefit the public, RESISTED THE PROPOSITION; and it was only when selfish interests were made to succumb to the general good, that an act of Parliament was obtained for the first railway. Yet so jealous had the legislature been of every innovation, that the Sankey Canal, of some six miles long, near Warrington, had only been allowed to be made with the express condition, that the boats intended to ply upon it should be propelled by no power except that of human labour: but in derision of antiquated contrivances, and all obstacles, the railway admonishes the advocate of retrogression; for on passing along its line, the traveller may survey the comparatively deserted old high road, that conserved canal where men are still beasts of burden, the Bridgewater Canal, and the old river; and steam, the school-

master of improvement, now leaves behind the slow boats and slow coaches of former days."—Pp. 20-24.

An engineer of the same class as Brindley is here presented to the attention of the reader. Of all the generators of motive power, none occupies a higher place than Mr. Fairbairn. Endowed by nature with the fervid genius and the indomitable perseverance characteristic of Scotchmen, he has by his inventive and constructive skill conferred on the world incalculable advantages, and made for himself a name whose repute is limited only by the four quarters of the globe.

The subject of this sketch was born at Kelso, in Roxburghshire, on the 19th of February, 1789. He received the rudiments of a very defective education, first at the parish school in that town, and afterwards at the school of Millachy in the Highlands of Scotland, where he resided from his tenth to his fourteenth year. From this training he acquired some skill in reading and writing, accompanied with a very limited knowledge of arithmetic and a slight acquaintance with bookkeeping and mensuration. On quitting school he was bound an apprentice to an engine-wright in Northumberland. During his period of service he extended his knowledge to the earlier books of Euclid, a few algebraic problems, and the more popular works of English literature. On these subjects, by untiring perseverance in a rigid system of self-instruction, he acquired some useful information, and laid the foundation of those tastes and habits which up to the present hour have been his sole means of relaxation, and proved to him a ceaseless source of increasing usefulness. Prompted by impulses which were felt rather than understood, the apprentice, after the labours of the day, spent his evenings in the recreations of study; and now that he has risen to a very high rank among men of practical science, William Fairbairn still occasionally looks back on this period of his early history with no small degree of pride and satisfaction.

On the termination of his apprenticeship, the young engineer went to London, where he worked for two years as a journeyman millwright; and during his leisure hours constructed several machines of considerable merit. After a roving excursion over most parts of England, South Wales, and a part of Ireland—working his way the whole time—he finally settled in Manchester, in October, 1814, and shortly after commenced business on his own account, with no capital and very few friends. Forming a partnership with Mr. James Lillie, a man of strict integrity, he began in a resolute spirit to struggle with the difficulties incident to his position.

At an early date in his mechanical career, Mr. Fairbairn's attention was directed to the very great defects which existed in the machinery of transmission, or the system of millwork then in use for driving cotton factories. The mills of Lancashire and other districts were then moved by ponderous square shafts and large wooden drums, making seldom more than forty revolutions per minute. Assured that he could effect a great improvement, Mr. Fairbairn prevailed on one of the largest spinners to consent to the complete alteration of his mill-gearing: the whole factory was gutted, and in lieu of shafts seven to eight inches square, and wooden drums four feet and upwards in diameter, Mr. Fairbairn boldly introduced light cast-iron pulleys with wrought-iron shafting, varying from two and a half to three inches, and increased the speed so as to obtain from 100 to 160 revolutions per minute. Here was a gain of power four-fold! This improvement was followed by an entirely new principle of coupling the shafts, since denominated "the circular half-lap coupling." A natural consequence was a great augmentation of business; and from that day may be dated Mr. Fairbairn's success in life. Steadily pursuing the useful and honourable career on which he had now entered so satisfactorily, he accomplished several important improvements in the construction of mill-work, water-wheels, and other hydraulic machines.

Towards the end of the year 1829, Mr. Fairbairn's attention was directed to the possibility of increasing the speed of boats in their passage through canals, and at the request of the Forth and Clyde Canal Company, he instituted a series of experiments to determine the tractile force at velocities

varying from three to fourteen miles an hour; and further to ascertain how far and with what advantage steam could be applied either as a tractive or propelling power instead of horses. These experiments were published at the expense of the company; and although the objects for which they were undertaken were not fully realised, they led the author's mind to a subject of higher importance, namely, the employment of iron as a material for shipbuilding. Iron boats were indeed in use previously, but they had never been constructed on principles fitted to enable them to resist the violence of storms, and to meet all the requirements of vessels intended to navigate the open sea. Mr. Fairbairn, aware of the importance of this new field of inquiry, bestowed thereon the full energy of his powerful intellect, and was rewarded with great success. Among the earliest improvers of this branch of practical science, he embarked largely in the manufacture of them both in London and in Manchester, and has since constructed above 100 iron ships, some of them war-frigates of nearly 2,000 tons burden.

During the years 1834-1835, the use of a hot blast for melting iron ores became prevalent, and along with this important improvement a very inferior description of iron was introduced. To relieve the public mind, and determine the relative merits of the new manufacture, Mr. Fairbairn and Mr. (now Professor) Hodgkinson were requested by "The British Association for the Advancement of Science" to investigate the cause of certain supposed defects; and after a most laborious experimental research, the reports of both gentlemen were published in full in the "Transactions" of the Association.

Almost simultaneously with this investigation into the properties and comparative value of the hot and cold blast-iron, Mr. Fairbairn instituted an experimental inquiry into the relative values and properties of all the British irons. The valuable results were published in the "Memoirs of the Literary and Philosophical Society of Manchester." These papers were at intervals followed by others on scientific subjects, which were honoured with the approval of learned societies, and published in their "Transactions." Whilst these investigations were going forward for the purpose of discovery and improvement, Mr. Fairbairn was involved in the multi-form and engrossing duties of large engineering establishments, the successful conduct of which has largely increased his reputation and augmented his wealth.

The most distinguished and lasting monument which Mr. Fairbairn has hitherto erected to his fame, is his construction of the Britannia and Conway Tubular Bridges. The conception of the grand and novel design, as Mr. Fairbairn has unreservedly stated, belongs to Mr. Stephenson, who also deserves high praise for the share which he took in the labour as a colleague with the subject of this memoir. The respective shares taken in the construction by these two eminent men have unhappily been brought into dispute. While we maintain the just rights of the one, we have no wish whatever to derogate from the merit of the other; and an impartial review of the controversy authorises us to say, that without Mr. Fairbairn's practical knowledge and skill, Mr. Stephenson's idea would not have been carried into effect.

The reputation acquired by Mr. Fairbairn generally as a constructive engineer, has led to his services being put in requisition in all parts of Europe, whether for the heavier sort of mill work, iron shipbuilding, or locomotive engines; he has also successfully erected more than one hundred public bridges from forty to two hundred feet in span.

These eminent services have brought him honours from many quarters. Learned societies and crowned heads have bestowed on him tokens of their sense of his great and numerous merits.

While thus reaping the appropriate rewards of his genius, enterprise, and industry in the highest walks of life, Mr. Fairbairn, glad to help others to rise, occasionally devotes the resources of his richly-furnished mind to the instruction of the humbler classes. Two lectures are before us on "The Construction of Boilers," and on "Boiler Explosions," which

he recently delivered before the Leeds Mechanics' Institution. From this pamphlet we make a quotation:—

"The modifications of the steam-engine which have been adopted since its introduction by Watt, three-quarters of a century ago, have been very numerous and varied; and although the progression in its applications and improvements has been most rapid and wonderful, we are still undecided as to the best form of its construction. Sound principles, scientifically applied, and the gradually increasing excellence of our workshop, have enabled us to attain the great perfection which characterises the working parts of the modern steam-engine. The steam-engine itself may be regarded as a comparatively perfect machine, and I shall, therefore, confine my observations almost exclusively to that very important and necessary adjunct, the boiler, which is the source of all its power. With this limitation a very wide field of inquiry is opened out, and in the earliest steps of the investigation we become perplexed with the endless variety of forms and constructions which at different periods have been adopted by engineers, and which have never, unfortunately, received the same judicious attention that was paid to the steam-engine. This is an anomalous and much-to-be-regretted fact, for the boiler being the source of the motive-power, is one of the most important parts of the whole machine. Upon its proper proportions and arrangements for the generation of steam depend the economy and regularity with which the engine can be worked; and upon its strength and excellence of workmanship depends the safety of the lives and property of those who come in contact with it. Regarding the steam-engine as one of the most active agents in the extension of our prosperity, and in the civilization of the world, and seeing how it is mixed up with the daily duties and workings of society, the safety and efficiency of every part, and more especially the boiler, are subjects of national importance; and I feel gratified by being called upon to lay before you such knowledge and experience on this subject of deep interest as I myself possess."

EARTHLY HONOURS.

(A Sonnet by Edward Bolton, published in 1610.)

"As withereth the primrose by the river,
As fadeth summer's sun from gliding fountains,
As vanisheth the light-blown bubble ever,
As melteth snow upon the massy mountains;
So melts, so vanisheth, so fades, so withers,
The rose, the shine, the bubble, and the snow
Of praise, pomp, glory, joy—which short life gathers.
Fair praise, vain pomp, sweet glory, brittle joy,
The wither'd primrose by the mourning river,
The faded summer sun from weeping fountains,
The light-blown bubble vanished for ever,
The molten snow upon the naked mountains,
Are emblems—that the treasures we up-lay
Soon wither, vanish, fade, and melt away."

THE CASCADE OF THE ROCK.

SOME of the most romantic and picturesque scenes in all fair France are to be found in the department of the Haute-Loire. Geologists tell us that, in days gone by, the district was torn by volcanic eruptions, and the traces of the lava are still to be found. This gives to the place a wild and somewhat terrible grandeur. Elevated peaks bristle over a black and yawning gorge, which, branching off into deep and mysterious recesses, forms the upper basin of the principal valley, in which two mountain rills, the Dor and the Dogue, unite, and give their joint names to a noble river. The rocks, lifting their craggy peaks on high, the fissures in those rocks, the unknown depths which they disclose, the giant trees, the roar of the falling waters, all combined, present a picture of remarkable interest, such an one as Salvator Rosa would have loved to paint. It is a singularly suggestive spot to the imaginative temperament. We people the towering rocks and beautiful green valleys with creatures of our own fancy, weave out a story for each